NOTICE

U.S. Department of Transportation

Federal Aviation Administration

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**Cancellation
Date: 8/04/01**

SUBJ: GUIDELINES FOR SOFTWARE CONFORMITY INSPECTION AND SOFTWARE
CONFORMITY REVIEW

1. **PURPOSE.** This notice provides guidelines to Aircraft Certification Office (ACO) engineers, Manufacturing Inspection District/Satellite Office (MIDO/MISO) inspectors, Certification Management Office/Certification Management Unit (CMO/CMU), Designated Engineering Representatives (DER), Designated Manufacturing Inspection Representatives (DMIR), Designated Airworthiness Representatives (DAR), and Organizational Designated Airworthiness Representatives (ODAR) regarding the processes of software conformity inspection and software conformity review. These guidelines are applicable for software conformity reviews and inspections related to type certificates (TC), supplemental type certificates (STC), amended supplemental type certificates (ASTC), amended type certificates (ATC), and Technical Standard Order Authorizations (TSOA).

2. **DISTRIBUTION.** This notice is distributed to the branch level in Washington Headquarters Aircraft Certification Service, section level in all Aircraft Certification Directorates, all National Resource Specialists (NRS), all Aircraft Certification Offices (ACO), all Manufacturing Inspection Offices (MIO), all Manufacturing Inspection District or Satellite Offices (MIDO/MISO), all Certificate Management Offices or Certificate Management Units (CMO/CMU), and all Flight Standards District Offices (FSDO). Additional limited distribution should be made to the Air Carrier District Offices, the Aeronautical Quality Assurance Field Offices, and the FAA Academy.

3. **RELATED PUBLICATIONS.**

   a. Advisory Circular 20-115B, "RTCA, Inc. Document RTCA/DO-178B," dated January 11, 1993.

   b. RTCA, Incorporated, document RTCA/DO-178B, "Software Considerations in Airborne Systems and Equipment Certification," dated December 1, 1992.

   c. FAA Order 8110.4B, "Type Certification Process," dated April 24, 2000.

4. BACKGROUND. Advisory Circular 20-115B recognizes DO-178B as a means, but not the only means, to secure FAA approval of the digital computer software. There has been some misconception pertaining to the term "*software conformity review,*" as described in DO-178B, and "*software conformity inspection,*" as described in FAA Order 8110.4B. Each type of conformity activity has its own separate and distinct meaning. This notice provides clarification and guidance to the ASI and Aviation Safety Engineer (ASE) regarding software conformity activities. This notice focuses on clarification and use of DO-178B in the conformity process, since DO-178B is the typical means of compliance used by applicants integrating airborne software. If some other means of compliance is used, the conformity concepts will still apply; however, clarification from AIR-130 may be necessary.

5. DISCUSSION AND PROCEDURES.

    a. There are two types of software conformity inspection: design assurance software conformity inspection and installation conformity inspection, and one type of software conformity review. The two types of conformity inspection are typically performed by an ASI (or designee, if delegated) after a Request for Conformity (FAA Form 8120-10) or Type Inspection Authorization (TIA - FAA Form 8110-1) is received from an ASE. A Statement of Conformity (FAA Form 8130-9) or TIA approval is completed after the conformity inspection is successfully performed.

    b. A conformity inspection is required to ensure that the product being certificated complies with the type design (reference FAA Order 8110.4B, paragraph 2-11g.). For software, this means the conformity inspection is required to ensure that the approved software complies with the type design data for the software which is usually documented in the system or software configuration index (S/SCI) (or version description data) (reference RTCA DO-178B, Section 9.4). Additional guidance for software conformity inspections is contained in FAA Order 8110.4B paragraph 5-2d (9).

    c. The software conformity review is typically performed by a manufacturer's Software Quality Assurance (SQA) organization or a system developer's SQA organization. The software conformity review does not require FAA participation; however, a designee may participate, especially if they have been delegated approval authority or recommendation for approval authority for the software under review. The following paragraphs provide further clarification on these three conformity activities.

    (1) Design Assurance Software Conformity Inspection: A d*esign assurance software conformity* inspection is required to ensure that a test configuration of the software complies with its test baseline (i.e., its current configuration and type design data, referred to as "red label" equipment) before a test for certification credit is executed. A design assurance software conformity inspection may be conducted at a development workstation, in a test laboratory, or on the aircraft at the system developer's facility or an aircraft manufacturer's facility. Additional guidance for a design assurance software conformity inspection is contained in FAA Order 8110.4B, paragraph 2-11f(4), paragraph 5-2d(9), and paragraph 5-5. In addition to design assurance software conformity inspections for test baselines, a final design assurance software conformity inspection must be completed for the final software product version (i.e., before it is considered "black label" equipment.)

(a) FAA Order 8110.4B, paragraph 2-11f(4) discusses conformity of the test article, test setup, test procedures used, and the validity of the test results. For a design assurance conformity inspection, the test specimen (software test baseline) and test setup (test environment - hardware, peripherals, and other software) must be conformed to the FAA-approved test plan and engineering drawings (test system configuration index and test baseline software configuration index or similar configuration documents).

> NOTE: The FAA–approved test plan is the test plan approved prior to conducting an official FAA ground or flight test. It is not the Software Verification Plan referenced in DO-178B.

(b) RTCA/DO-178B provides a means of achieving some of the design assurance software conformity inspection actions. Section 7 of RTCA/DO-178B defines the software configuration management (SCM) process objectives that are intended to provide the data needed to perform the inspection. Typically, at the time of the conformity of "red label" units, the DO-178B SCM objectives are not yet completed. However, since the SCM process is an integral process, the configuration records should be in place. The applicant should be following their approved SCM plan and the SCM records should provide visibility to a defined and controlled configuration, provide a known point for review (baselines), provide evidence of approval of the software, and ensure that secure physical archiving, recovery, and control are maintained. In addition to the criteria of FAA Order 8110.4B referenced in paragraph 5a above, the ASI (or designee, if delegated) for a design assurance software conformity inspection should determine:

1 That the baseline identifies the relevant software life cycle data for the baseline, including version/revision identifiers and dates, and that the applicant's or manufacturer's Statement of Compliance has been completed. For software, this Statement of Compliance is typically documented on a completed FAA Form 8110-3 submitted by a delegated designee, or as a part of a TSO application and data package submittal by the TSO equipment manufacturer.

2 That any software development tools or software verification tools, that needed to be qualified, were qualified. If the tool qualification activities are not completed at the time of conformity, the tools and supporting data should have their configuration documented.

3 That an ACO ASE has concurred that the baseline shows compliance to its requirements and approved software plans; or that a software DER (if delegated) has approved the baseline by submitting a FAA Form 8110-3, "Statement of Compliance with the Federal Aviation Regulations."

4 That the procedure used for retention, archival and retrieval of the software life cycle data is compliant with the Software Configuration Management Plan approved by the FAA or a delegated designee.

(c) This conformity inspection should be successfully conducted before requesting a software installation conformity inspection.

(2) <u>Software Installation Conformity Inspection:</u> A *software installation conformity inspection* is conducted after a design assurance software conformity inspection, during or after the software is loaded or system containing the software is installed on the aircraft, and before any official FAA ground or flight testing is conducted. The criteria for this inspection are typically those of FAA Order 8110.4B, paragraph 5-2d(9)(f) through paragraph 5-2d(9)(j). The main objectives are to show that an approved, controlled version of the software is loaded successfully into the target system in conformance with approved system installation procedures and/or software loading procedures, and that the correct version for that system was loaded and will successfully initialize.

(a) A software installation conformity inspection is required anytime a FAA aircraft-level ground or flight test is performed, such as those conducted per the Type Inspection Authorization (TIA). An installation conformity inspection of the hardware and the software of the system installed in the aircraft should be performed. This installation conformity inspection requires that the FAA or designee verify the correct software version has been loaded into the system and that the correct system hardware (part numbers and serial numbers) has been installed on the aircraft prior to conducting any FAA aircraft level testing.

(b) The loading procedure(s) should ensure that the correct software part number (and version number) is loaded into the correct system hardware components (serial numbers and part numbers). And should indicate an error if the software loading procedure or ground support equipment detects a mismatch of part and version numbers or an unsuccessful load. The installation conformity inspection should determine that the manufacturer's loading procedure(s) are correct and that the software loads and initializes correctly. Mismatches should be identified and documented.

(c) The ASI or designee, if delegated, can perform the software installation conformity by one of two methods:

1 By physically witnessing the successful loading of the correct software part number and version into the actual system (i.e., actual part number and serial number) installed on the aircraft or to be installed on the aircraft. By witnessing that an integrity check was used to verify the load, and by witnessing that the software successfully executed the initialization procedure.

2 By obtaining the manufacturing inspection records that document the results of the actual software loading. These records should include aircraft identification information, system hardware part numbers and serial numbers, and software part numbers and version number, as applicable. The records provided should identify the hardware unit part number and serial number information so that the ASI (or designee, if delegated) can trace it to the system installed on the aircraft. The records provided should also show the software part number that was loaded into the system hardware. They should indicate when and how the software was loaded and that the loading and initialization process was successful.

(d) The ASE should provide to the ASI (or designee, if delegated), via the Request For Conformity Form, 8120-10, the software part number and/or version number for which a conformity inspection is being requested and any actions/activities to be verified. The software

part number and/or version number must be identifiable, under configuration control, reproducible, and documented in the System Configuration Index Document (CID) or similar configuration documentation.

(e) The software installation conformity inspection ensures that the system(s) installed on the aircraft and software loaded into the systems for the purpose of conducting aircraft level testing conforms to the FAA approved type design data.

(3) Software Conformity Review: A *software conformity review* is performed at the end of a software development project to show that the software complies with plans, standards and requirements. Partial software conformity reviews can also be conducted throughout the development to support the preparation of software test baselines. However, for the final software conformity review, all development and verification activities and data should be complete.

(a) The criteria for a software conformity review are defined in RTCA/DO-178B, Section 8.3. The objective is "to obtain assurances, for the software product submitted as part of a certification application, that software life cycle processes are complete, software life cycle data are complete, and executable object code is controlled and can be regenerated." While this effort can be continuous throughout the software development process, it generally culminates just prior to submission of the final product for certification.

(b) The software conformity review establishes that a specific software product, consisting of the executable object code and all the applicable software life cycle data has been completed, documented, approved, and archived. The software life cycle data (i.e., software configuration index or version description data), that describes the software product, should reference all applicable software life cycle data to which the software product was designed, built, assembled, compiled, linked, loaded, verified, controlled and assured. It also ensures that all planned activities have been completed and all objectives and criteria were satisfied.

(c) This activity is typically accomplished by the aircraft manufacturer's SQA personnel or system/product manufacturer's SQA personnel. This activity is not performed by an ASE, ASI or designee. A designee may choose to participate, especially if he/she has been delegated authority for approval or for recommendation of approval of the software. An ASE (or software DER, if delegated), supported by the assigned MIDO/MISO/CMO/CMU ASI (or software DMIR, if delegated), can assure this review has been successfully completed.

(d) The Software Accomplishment Summary should summarize the actual development and contain a statement of compliance with DO-178B objectives (or an acceptable alternative) and the software plans and standards. The summary should also document any additional rulings, deviations to plans, standards and DO-178B objectives; and should describe any additional activities performed and resultant data relevant to the project that was not originally planned (for example, tool qualification, deferred functionality, deferred problem report resolution).

(e) In the event of a need to investigate software suspected anomalies in service, it may be necessary to retrieve the software life cycle data from the configuration management library or other records, which may be vital to investigators for analysis purposes. Software data retention

should meet Title 14 Code of Federal Regulations (CFR) Part 21, type design data retention requirements.

6. CONCLUSION. The information and procedures described in this notice promote clarification and consistent application of DO-178B and Order 8110.4B for software conformity reviews and software conformity inspections. This notice does not replace or supersede AC 20-115B, DO-178B, or Order 8110.4B.

James C. Jones
Manager, Aircraft Engineering Division
Aircraft Certification Service